



## NTE864 Integrated Circuit Precision Waveform Generator

### **Description:**

The NTE864 is a precision waveform generator in a 14-Lead DIP type package capable of producing sine, square, triangular, sawtooth and pulse waveform. Its operating frequency can be selected over eight decades of frequency, from 0.001Hz to 200kHz. The frequency of oscillation is highly stable over a wide range of temperature and supply voltage changes. Both full frequency sweeping as well as smaller frequency variations (FM) can be accomplished with an external control voltage. Each of the three basic waveforms, i.e., sinewave, triangle and square wave outputs are available simultaneously, from independent output terminals.

### **Applications:**

- Precision Waveform Generation: Sine, Triangle, Square, Pulse
- Sweep and FM Generation
- Tone Generation
- Instrumentation and Test Equipment Design
- Precision PLL Design

### **Absolute Maximum Ratings:**

Power Supply Voltage, $V_{CC}$ .....	36V
Power Dissipation, $P_D$ .....	625mW
Derate Above $+25^\circ C$ .....	5mW/ $^\circ C$
Storage Temperature Range, $T_{stg}$ .....	$-65^\circ$ to $+150^\circ C$
Operating Temperature Range, $T_{opr}$ .....	$0^\circ$ to $+70^\circ C$

### **System Description:**

The NTE864 precision waveform generator produces highly stable and sweepable square, triangle, and sine waves across eight frequency decades. The device time base employs resistors and a capacitor for frequency and duty cycle determination. The generator contains dual comparators, a flip-flop driving a switch, current sources, buffers, and a sine wave converter. Three identical frequency waveforms are simultaneously available. Supply voltage can range from 10V to 30V, or  $\pm 5V$  to  $\pm 15V$  with dual supplies.

Unadjusted sine wave distortion is typically less than 0.7%, with Pin1 open and  $82k\Omega$  from Pin12 to Pin11 ( $-V$  or GND). Sine wave distortion may be improved by including two  $100k\Omega$  potentiometers between  $V_{CC}$  and  $-V$  (or GND), with one wiper connected to Pin1 and the other connected to Pin12.

Small frequency deviation (FM) is accomplished by applying modulation voltage to Pin7 and Pin8; large frequency deviation (sweeping) is accomplished by applying voltage to Pin8 only. Sweep range is typically 1000:1.

## System Description (Cont'd):

The square wave output is an open collector transistor; output amplitude swing closely approaches the supply voltage. Triangle output amplitude is typically 1/3 of the supply, and sine wave output reaches 0.22 of the supply voltage.

**Electrical Characteristics:** ( $V_S = \pm 5V$  to  $\pm 15V$ ,  $T_A = +25^\circ C$ ,  $R_L = 1M\Omega$ ,  $R_A = R_B = 10k\Omega$ ,  $C_1 = 3300pF$ ,  $S_1$  closed, unless otherwise specified.)

Parameter	Test Conditions	Min	Typ	Max	Unit
<b>General Characteristics</b>					
Supply Voltage, $V_S$ Single Supply		10	—	30	V
Dual Supplies		$\pm 5$	—	$\pm 15$	V
Supply Current	$V_S = \pm 10V$ , Note 1	—	12	15	mA
<b>Frequency Characteristics</b> (Measured at Pin9)					
Range of Adjustment Max. Operating Frequency	$R_A = R_B = 1.5k\Omega$ , $C_1 = 680pF$ , $R_L = 10k\Omega$	200	—	—	kHz
Lowest Practical Frequency	$R_A = R_B = 1M\Omega$ , $C_1 = 500\mu F$ , (Low Leakage Cap)	—	0.001	—	Hz
Max. Sweep Frequency of FM Input		—	100	—	kHz
FM Sweep Range	$S_1$ Open, Note 2, Note 3	—	1000: 1	—	—
FM Linearity 10:1 Ratio	$S_1$ Open, Note 3	—	0.1	—	%
Range of Timing Resistors	Values of $R_A$ and $R_B$	0.5	—	1000	k $\Omega$
Temperature Stability		—	50	100	ppm/ $^\circ C$
Power Supply Stability	Note 4	—	0.05	—	%/V
<b>Output Characteristics</b>					
Square Wave (Pin9) Amplitude (Peak-to-Peak)	$R_L = 100k\Omega$	0.9	0.98	—	$\times V_{SPLY}$
Saturation Voltage	$I_{SINK} = 2mA$	—	0.2	0.4	V
Rise Time	$R_L = 4.7k\Omega$	—	100	—	ns
Fall Time	$R_L = 4.7k\Omega$	—	40	—	ns
Duty Cycle Adjust		2	—	98	%
Triangle/Sawtooth/Ramp (Pin3) Amplitude (Peak-to-Peak)	$R_L = 100k\Omega$	0.3	0.33	—	$\times V_{SPLY}$
Linearity		—	0.05	—	%
Output Impedance	$I_{OUT} = 5mA$	—	200	—	$\Omega$
Sine-Wave Distortion Amplitude (Peak-to-Peak)	$R_L = 100k\Omega$	0.2	0.22	—	$\times V_{SPLY}$
Unadjusted	$R_L = 1M\Omega$ , Note 5, Note 6	—	0.7	1.5	%
Adjusted		—	0.5	—	%

Note 1 Currents through  $R_A$  and  $R_B$  not included.

Note 2  $V_{SUPPLY} = 20V$

Note 3 Apply sweep voltage at Pin8.  $V_{CC} - (1/3 V_{SUPPLY} - 2) \leq V_{PIN8} \leq V_{CC}$ ,  $V_{SUPPLY}$  = Total Supply Voltage across the IC

Note 4  $10V \leq V_S \leq 30V$  or  $\pm 5V \leq V_S \leq \pm 15V$ .

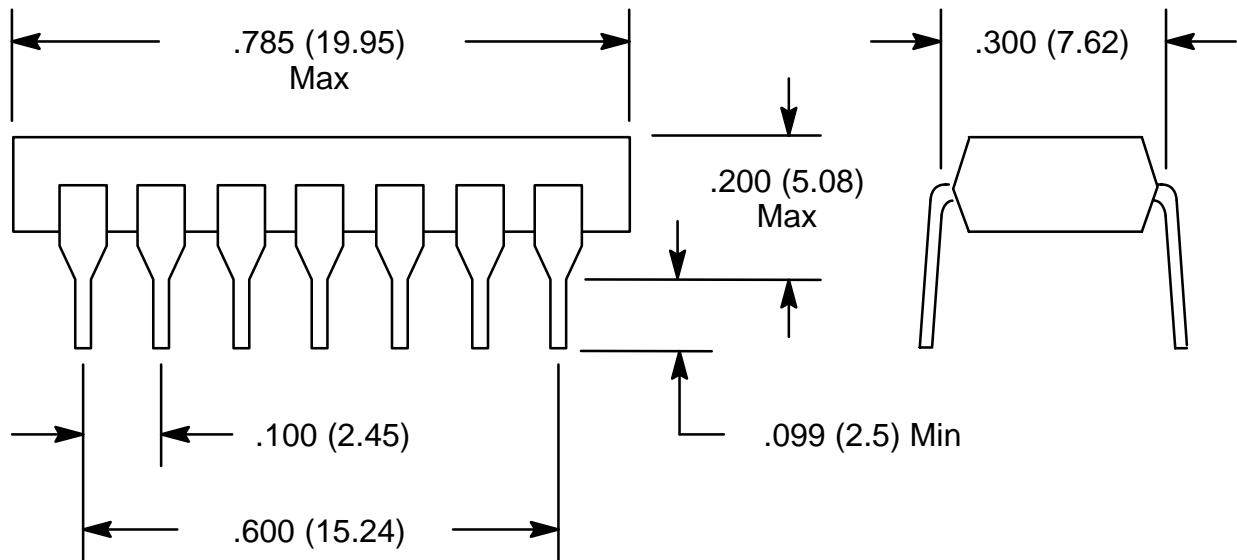
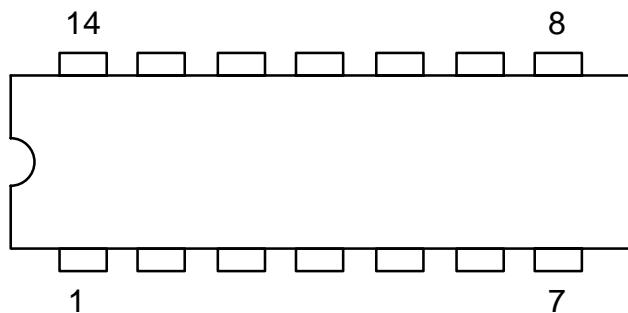
Note 5  $82k\Omega$  resistor connected between Pin11 and Pin12.

Note 6 Triangle duty cycle set at 50%, use  $R_A$  and  $R_B$ .

Note 7 As  $R_L$  is decreased distortion will increase,  $R_L$  min.  $\approx 50k\Omega$ .

Pin Connection Diagram

Sine Adjust	<b>1</b>	14	N.C.
Sine Wave	<b>2</b>	13	N.C.
Sawtooth Wave	<b>3</b>	12	Sine Adjust
Duty Cycle Adjust	<b>4</b>	11	GND
Duty Cycle Adjust	<b>5</b>	10	Timing Capacitor
(+) V <sub>CC</sub>	<b>6</b>	9	Square Wave
FM Bias	<b>7</b>	8	FM Sweep Input



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